pressure measured at pressure gage 49) is not required in order to determine the pilot pressure in pilot line 67 (this pilot pressure corresponds to the set pressure of relief valve 46). Based upon this contention, the Examiner concludes that the statement made in the Amendment by the Applicants that "the specification teaches a control unit 23B that operates to control the pressure supplied from hydraulic pump to be higher than the pressure required to drive a hydraulic motor by a predetermined amount" contradicts the statement "[f]rom this disclosure, one skilled in the art... would understand that the current supplied to the electromagnetic relief valve 46 (signal 36) is related to the pressure of the supply pressure (the pressure measured at pressure gage 49...), the pressure at the hydraulic motor 43... and the predetermined pressure".

Applicants respectfully submit that the Examiner has failed to fully recognize the nature of the Applicants' invention. In one preferred aspect, Applicants' invention, disclosed both in the specification and drawings as discussed below, relates to a closed-loop feedback control system for controlling the pressure of fluid delivered to a hydraulic motor. As the artisan of ordinary skill in the art would recognize, in order to generate the error signal necessary to implement closed-loop control of a parameter, it is conventional to measure that parameter and to provide that measurement signal to the controller. The supply pressure measurement signal from pressure gage 49 is sent to the controller 23B to permit closed-loop control of the supply pressure.

Applicants respectfully submit that there is no contradiction between the statement that "the specification teaches a control unit 23B that operates to control the pressure supplied from hydraulic pump to be higher than the pressure required to drive a hydraulic motor by a predetermined amount" and the statement "[f]rom this disclosure, one skilled in the art... would understand that the current supplied to the electromagnetic relief valve 46 (signal 36) is related to the pressure of the supply pressure (the pressure measured at pressure gage 49...), the pressure at the hydraulic motor 43... and the predetermined pressure". On the contrary, Applicants submit that the person of ordinary skill in the art would recognize that it is conventional to measure the parameter being controlled (in the present case, the pressure of fluid being supplied to the hydraulic motor, as measured by pressure gage 49), supply that measurement to the controller (in the present case, controller 23B) and generate a signal to adjust

a control parameter (in the present case, signal 36 used to adjust the set pressure of electromagnetic relief valve 46), with the control signal being mathematically related to the measured control parameter. Consequently, Applicants respectfully submit that there is no discrepancy or contradiction in the statement that "pressure supplied from hydraulic pump to be higher than the pressure required to drive a hydraulic motor by a predetermined amount" and the statement that "the current supplied to the electromagnetic relief valve 46 (signal 36) is related to the pressure of the supply pressure (the pressure measured at pressure gage 49...), the pressure at the hydraulic motor 43... and the predetermined pressure".

The Examiner further argues that the numerical control unit 401 of Ikebe *et al.* "inherently includes or is connected to the operational position inputting means" and "the operation position outputting means would inherently be part of and/or connected to the control unit 401". Applicants respectfully traverse the Examiner's assertion that the **specific** operational position inputting means and the operation position outputting means disclosed in the Applicants' specification **necessarily** flows from the teachings of Ikebe *et al.* "In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d, 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original). Applicants respectfully submit that the Examiner has failed to meet this burden. The Examiner asserts that a control element of Ikebe *et al.* could take a variety of alternative forms. However, the Examiner does not explain how the specific operation lever 21 and operation position outputting means 22 of Applicants' invention are derivable from the teachings of Ikebe *et al.* Accordingly, Applicants respectfully submits the Examiner's basis for rejection is conclusory.

As discussed in detail below, the Examiner has failed to identify any element in either of the prior art references corresponding to the oil pressure control means and supplying oil pressure detection means of the present invention. Thus, Applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 with regard to claims 1 and 3.

Claim Rejections Under 35 U.S.C. §112

The Examiner has rejected claims 1-5 under 35 U.S.C. §112, first paragraph as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention; in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention; and/or because the best mode contemplated by the inventor has not been disclosed. More specifically, citing claim 1, lines 45-54 and the specification page 52, lines 5-8 and page 53, line 11 to page 54, line 3, the Examiner contends:

> the above claim and discussion indicates that the pressure difference between the pressure supplied by the pump and the pressure of the working oil is a maximum of 20 kg/cm^2. Since the main relief valve 45 is moved to an open position by the pressure supplied by the pump and moved toward a closed position by pressure in pilot line 67 and by the spring; to achieve this pressure difference, the pressure in the pilot line plus a pressure corresponding to the spring must be equal to the working pressure plus the 20 kg/cm^2. Since the pressure in the pilot line 67 is only a function of the working pressure, the current sent to the electromagnetic relief valve 46 is only a function of the working pressure, and therefore it is unclear why the supply pressure is sent to the control unit 23B, and how the supply pressure is used to generate the current for the electromagnetic relief valve 46.

Applicants respectfully traverse this rejection.

As discussed above, Applicants respectfully submit that the Examiner has failed to fully recognize the nature of the Applicants' invention. The Applicants have disclosed a closed-loop feedback control system for use with a hydraulic pump and motor system. Beginning on page 52, line 15, the specification teaches,

> [t]he drive oil pressure signals output from the pressure gages 47 and 48 are input through signal transmission paths 33 and 34 to the oil pressure control circuit 23B. Further, a supplying-oil pressure signal output from the pressure gauge 49 is input to the oil pressure control circuit 23B through a signal transmission path 35. The drive oil pressure signals are respectively generated by the pressure gauges 47 and 48 depending on pressures of he working oils in the oil passages 64 and 65 which are detected by the pressure gauges

47 and 48. The supplying-oil pressure signal is generated by the pressure gauges 49 depending on a pressure of the working oil in an oil passage 63, which is detected by the pressure gauge 49.

The oil pressure control circuit 23B varies a pressure of the working oil supplied from the hydraulic pump 42 to the directional control valve 25 in the following way by varying the current output therefrom.

When the oil pressure control circuit 23B varies the current that is output through the signal transmission path 36 to the electromagnetic relief valve 46, a set pressure of the electromagnetic relief valve 46 varies since the set pressure of the electromagnetic relief valve 46 is determined by the current input thereto. Since the pressure of the pilot oil in the pilot oil passage 67 is equal to the set pressure in the electromagnetic relief valve 46, the pressure of the pilot oil also varies with variation of the set pressure of the electromagnetic relief valve 46. The set pressure of the main relief valve 45 is determined by the pressure of the pilot oil. Therefore, when the pressure of the pilot oil varies, the set pressure of the main relief valve 45 also varies. Further, the main relief valve 45 controls the pressure of the working oil that is supplied from the hydraulic pump 42 to the directional control valve 25 to be the set pressure or lower. When the set pressure of the main relief valve 45 varies, the pressure of the working oil supplied from the hydraulic pump 42 to the directional control valve 25 also varies.

As described above, the oil pressure control circuit 23B is able to vary the pressure of the working oil supplied from the hydraulic pump 42 to the directional control valve 25 by varying the current fed to the electromagnetic relief valve 46.

Fig. 1 discloses the oil pressure control circuit 23B receiving input signals 33, 34 and 35 from pressure gauges 47, 48 and 49, respectively. Fig. 1 further illustrates the current signal 36 being transmitted to the electromagnetic relief valve 46. Based on the foregoing discussion and Fig. 1, Applicants respectfully submit that a person of ordinary skill in the art would recognize that the supply pressure as measured by the pressure gage 49 is used as an input to the controller 23B to provide a feedback signal for the closed-loop control of the pump discharge pressure.

With respect to the Examiner's second contention that the specification is not enabling to one of ordinary skill in this art, as the relationship between the working and supply pressures and the current is not specified, Applicants submit that the artisan would understand that a variety of controllers 23B, for example a PID (proportional – integral – derivative) controller, a PI (proportional – integral) controller or a PD (proportional – derivative) controller could be used for the controller 23B. Controllers are well known in the art, and the artisan would recognize that a detailed description of their operation is not necessary for the disclosure to be enabling. Applicants thus respectfully submit that the artisan would recognize that a detailed disclosure of the specific mathematical algorithm by which the controller 23B converts the measurement signal 36 corresponding to the pressure gage 49 and the signals 33 and 34 corresponding to pressure gages 47 and 48, respectively, into the current signal 36 sent to the electromagnetic relief valve 46 is not required for the person of ordinary skill in the art to make and use the invention and that the disclosure is fully enabling under 35 U.S.C. § 112.

In view of the foregoing, Applicants respectfully submit that claims 1-5 are in full compliance with 35 U.S.C. §112, first paragraph and request that the rejection of claims 1-5 under section 112 first paragraph be withdrawn.

Claim Rejections Under 35 U.S.C. §103

The Examiner has rejected claims 1 and 3 under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 3,621,762 (Ikebe *et al.*) in view of U.S. Patent No. 4,468,173 (Dantlgraber). The Examiner states that Ikebe *et al.* discloses all of the elements of claim 1 of the present invention with the exception of disclosing the following:

> a main relief valve for regulating a pressure of the working oil supplied from the supplying means to be equal to or lower than a set pressure,
>
> an electromagnetic relief valve for varying the set pressure of the main relief valve, and
>
> oil pressure control means for receiving the drive oil pressure signal from the drive oil pressure detecting means and outputting a current to the electromagnetic relief valve to vary the set pressure of the main relief valve, thereby controlling the pressure of the oil supplied by the supplying means to be higher, by

a predetermined pressure, than the pressure of the working oil of the rotary member.

The Examiner, in particular, contends that numerical control unit 401 inherently discloses an element which corresponds to the operation position inputting means of the present invention. The Examiner further contends that the numerical control unit 401 further inherently discloses an element which corresponds to the operation position signal outputting means of the present invention.

Further, the Examiner contends that Dantlgraber teaches a supplying means supplying pressurized working oil to a hydraulic motor. Still further, the Examiner contends that the supplying means of Dantlgraber includes:

> a variable displacement pump,
> a main relief valve (130) for regulating a pressure of the working oil supplied from the pump to be equal or lower than a set pressure,
> an electromagnetic relief valve (20) for varying the set pressure of the main relief valve and
> oil pressure control means for outputting a current to the electromagnetic relief valve to vary the set pressure of the main relief valve, thereby controlling the pressure of the oil supplied by the pump, for the purpose of conserving energy needed to drive the pump.

The Examiner takes Official Notice that:

> a variable displacement pump delivering pressurized oil to a hydraulic motor at a pressure regulated to be equal or lower than a set pressure, that the set pressure is a predetermined pressure above a load pressure of the motor, for the purpose of having sufficient pressure to drive the motor without wasting energy.

The Examiner opines that it would be obvious to an artisan to include the aforementioned features of Dantlgraber in a modified Ikebe *et al.* device,

> thereby controlling the pressure of the oil supplied by the pump as part of the supplying means of Ikebe *et al.*, as taught by Dantlgraber, for the purpose of conserving energy needed to drive the pump; with the set pressure being a predetermined pressure above a load pressure of the motor, for the purpose of having sufficient pressure to drive the motor without wasting energy.

Applicants respectfully traverse this rejection.

Claim 1 is directed to a hydraulic drive apparatus and recites, in pertinent part,

> operation position inputting means for inputting an operation position;
>
> operation-position signal outputting means for generating and outputting an operation position signal depending on the operation position input by the operation position inputting means;
>
> supplying oil pressure detect means for detecting a pressure of the working oil supplied from the working oil supplying means to the working oil control means, and generating and outputting a supplying-oil pressure signal depending on the pressure thus detected;
>
> a main relief valve for regulating a pressure of the working oil supplied from the working oil supplying means to the working oil control means to be equal to or lower than a set pressure;
>
> an electromagnetic relief valve for varying the set pressure of the main relief valve by varying a set pressure thereof; and
>
> oil pressure control means for receiving the supplying-oil pressure signal output from the supplying oil detect means and the drive oil pressure signal output from the drive oil pressure detecting means, and outputting a current to the electromagnetic relief valve to vary the set pressure of the electromagnetic relief valve and thus the set pressure of the main relief valve, thereby controlling the pressure of the working oil supplied from the working oil supplying means to be higher, by a predetermined pressure, than the pressure of the working oil for driving and rotating the drive rotary member.

Ikebe *et al.* does not disclose each and every element of the present invention. Ikebe *et al.* discloses a control system for an electrohydraulic motor wherein the gain of the motor is adjusted in accordance with the torque load imposed upon the motor, so as to maintain a constant total system gain. Ikebe *et al.* specifically discloses a pressurized oil source 112, which supplies oil to a hydraulic motor 111, via a spool 102 enclosed within a sleeve 106, the combination of the spool 102 and the sleeve 106 serving as a rotary pilot valve. The position of the spool 102 within the sleeve 106 is controlled by a electric pulse motor 101. Rotation of the electric pulse motor 101 is controlled by a pulse motor drive circuit 407, which receives input commands from a pulse train converter 402. The pulse train converter 402 receives an input signal from a numerical control unit 401. In steady state operation, the output signal F of the

numerical control unit 401 equals the output signal f of the pulse train converter 402. Consequently, Ikebe *et al.* teaches a control system for an electrohydraulic motor that modifies the gain factor K1 of the pulse train converter 402 during transient operation such that the total gain K of the control system is held constant.

The Examiner admits that Ikebe *et al.* fails to disclose each and every element of Applicants' invention. More specifically, the Examiner admits that Ikebe *et al.* does not disclose the main relief valve, the electromagnetic relief valve and the oil pressure control means.

As discussed above, Applicants respectfully disagree with the Examiner's contention that the numerical control unit 401 inherently includes elements corresponding to the operational position inputting and operation position outputting means of the present invention.

In summary, Applicants submit that Ikebe *et al.* fails to disclose not only the main relief valve, electromagnetic relief valve and oil pressure control means of the present invention, as admitted by the Examiner, but also the operation position inputting means, the operation position outputting means and the supplying oil pressure detect means of the present invention. Accordingly, there is no objective teaching in Ikebe *et al.* that would enable one of ordinary skill in the art to modify the invention of Ikebe *et al.* in a manner that would render the present invention obvious under 35 U.S.C. § 103(a).

Dantlgraber does not disclose each and every element of the present invention. Dantlgraber discloses a system capable of controlling a variable displacement pump used to supply oil to hydraulic devices. The system is capable of controlling the pump over separate high and low pressure ranges. More particularly, Dantlgraber discloses a variable displacement pump 1, a first pressure control valve 8, a second pressure control valve 30, a pressure transducing valve 25 and a solenoid-operated pressure relief valve 20. The two pressure control valves 8 and 30 operate to control the output pressure of the pump 1, with the control valve 30 effecting control in a lower pressure range and the control valve 8 effecting control in a higher pressure range. The relief valve 20 operates to select which control valve is operational.

Dantlgraber fails to teach, disclose or suggest the oil pressure control means of the Applicants' invention. Dantlgraber is silent regarding how the solenoid-operated pressure relief

valve 20 is controlled, and, in particular, contains nothing to teach, disclose or suggest closed-loop control of relief valve 20. Dantlgraber fails to disclose other elements of the present invention, including, the supplying oil pressure detect means, the rotation control means and the operation position inputting means. Accordingly, there is no objective teaching in Dantlgraber that would enable one of ordinary skill in the art to modify the invention of Dantlgraber in a manner that would render the present invention obvious under 35 U.S.C. § 103(a).

There is no objective teaching in Ikebe *et al.* or Dantlgraber, nor is there knowledge generally available to one of ordinary skill in the art, that would lead the artisan to combine the electrohydraulic control system of Ikebe *et al.* with the hydraulic pump pressure control system of Dantlgraber. Accordingly, the Ikebe *et al.* and Dantlgraber references are not properly combinable under 35 U.S.C. § 103(a) to render the present invention obvious.

Even if Ikebe *et al.* and Dantlgraber were combined, the combination does not render the present invention obvious. More specifically, the combination of Ikebe *et al.* and Dantlgraber fails to disclose at least the oil pressure control means, supplying oil pressure detection means, operation position inputting means and operation position outputting means. As Ikebe *et al.* combined with Dantlgraber fails to teach or suggest all of the elements of claim 1 of the Applicants' invention, it is respectfully submitted that a *prima facie* case for obviousness has not been established with respect to claim 1 and also with respect to claim 3 which depends directly from claim 1. Accordingly, it is requested that the rejection of claims 1 and 3 under 35 U.S.C. § 103(a) be withdrawn.

Allowable Subject Matter

Applicants acknowledge with appreciation that the Examiner has determined that claims 2, 4 and 5 would be allowable if rewritten to overcome the rejection under 35 U.S.C. § 112. In view of the foregoing remarks and Applicants' traverse of the rejection under 35 U.S.C. § 112, Applicants respectfully submit that claims 2, 4 and 5 are in condition for allowance.

CONCLUSION

In view of the foregoing amendment and remarks, Applicants respectfully submit that the present application, including claims 1-5, is in condition for allowance, and such action is respectfully requested.

Respectfully submitted,

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